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# The Florida Entomologist

Official Organ of the Florida Entomological Society.

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VOL. VI

SUMMER NUMBER

No. 1

JUNE, 1922

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## THE CORN LEAF-TIER, *LEREMA ACCIUS* S. & A.\*

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The corn leaf-tier, *Lerema accius* S. & A., is one of a large number of corn feeding species of insects which have never been known to cause appreciable damage, but are still a potential pest of this plant and of other economic grasses. It belongs to the *Hesperiidae* or skipper butterflies, several of which, in the South are recognized as pests, among them the Bean Leaf Folder (*Eudamus proteus* L.), and the Larger Canna Leaf Roller (*Calpododes ethlius* Cramer).

The original description of the adult was published in a paper on the "Lepidopterous Insects of Georgia" by Smith and Abbott in 1797 under the name of *Papilio accius*. In 1872 Mr. S. H. Scudder erected the genus *Lerema* with this species as the genotype. The most complete account so far published is one by this same author in his "Butterflies of New England" in 1889. The records of the Bureau of Entomology regarding this species are very meager. Mr. R. A. Vickery reported finding a single small larva on corn at Brownsville, Texas, Mr. W. R. McConnell noted it at several points in Mississippi, and Mr. W. H. Larrimer found larvae on two species of grasses at Chickasha, Oklahoma. The above records, a few other scattered observations and a series of rearings at Lakeland, Florida, during the winter and spring of 1913 furnish the material for the following paper.

It is impossible to fix definite limits for the range of this species. It was first described from Georgia, the exact locality not being indicated. An attached note adds that "It is also found in Virginia." Scudder's map of its distribution shows it

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to occur throughout a narrow strip of territory along the Gulf and Atlantic coasts as far north as Massachusetts, and another along the Mississippi River as far north as southern Illinois. It has been found by Mr. Larrimer at Chickasha, Okla., by the writer at Chattanooga and Leadvale, Tenn., and Clemson College, S. C., all outside of the above limits and indicating that its distribution is more general throughout the Southeastern states than Scudder's map leads one to believe. Like several of its close relatives it is probably of tropical origin and habit and if so its northern limit fluctuates from year to year with the severity of the winter and the conditions favoring northward flight during the summer.

The adult butterfly has a wing expanse of about 33 mm. and in color is a dark, warm brown with six more or less rectangular white spots on the fore wing of the female (in the male but four and these much smaller). Three of the six in the female are small and in a close, nearly straight row near the anterior margin about two-thirds out from the base of the wing; two others, of which the posterior is the larger, lie between this group and the hind margin of the wing, and the last at the upper edge of the cell. In different individuals the prominence of these markings varies considerably but their relative size and position are constant. The hind wing is uniform brown above, and beneath both fore and hind wings shade to purple along the distal margins. The butterfly is a strong flier and has the erratic, zig-zag flight characteristics of its family.

The eggs are laid singly and widely scattered, usually on the lower but sometimes on the upper surface of the leaf. Seldom is more than one found on a plant and we have never seen two on the same leaf. They are white with a pearly luster, sub-hemispherical in shape and about two-thirds as high as wide, with the basal angle rounded, diameter 1.2 mm., height .8 mm. The chorion is finely reticulated. The rounded basal angle serves to distinguish this from the otherwise very similar egg of *Calpodus ethlius* in which the wall joins the base with a sharp right angle.

Since oviposition has never been observed, the exact length of the incubation period is not known. Of eleven eggs taken in the field at various times, seven hatched in nine days, two in six days, and two in five days, indicating that nine days is probably the normal period. A day or two after being laid the

egg takes on a creamy tinge, on the sixth day a faint mottling appears near the apex and on the eighth day the dark head of the young larva can plainly be seen through the shell. The embryo lies coiled around the circumference of the egg with the head a little to one side of the center. The first break in the shell is made by pressure of the mandibles and the larva then proceeds to cut an irregular hole in the apex, rotating within the egg during the process. When the opening is as large as its head the larva emerges. The entire operation occupies some time, one larva which broke the shell at 8:00 A. M. having just released itself at 3:00 P. M. In the meantime the head of this larva changed from chocolate-brown to glistening black. The empty egg-shell is translucent white, waxy and parchment-like in texture except the flat base which is transparent.

After a brief survey of the immediate vicinity the newly hatched larva returns to the egg shell and consumes it, leaving only the disk-like base which it cannot be induced to touch even when it has been loosened from the leaf. This little glistening disk can almost invariably be found somewhere on each infested plant. After breakfasting on the egg-shell the small larva selects a location on the upper surface of the leaf, near the edge and begins to construct its retreat by placing a layer of silk fibers on the surface. The effect of this is quickly seen in the gradual curling of the blade. When a groove has been thus formed the opposite edges are connected by a silk fiber which bridges the concavity. This fiber is added to until it forms a strong strand and its contraction draws the edge over until it touches the surface of the blade, after which other similar attachments are formed at short intervals until a complete tube, open at both ends is formed. In the finished retreat of a full grown larva there are from five to twelve such fastenings. In the instances observed by the writer the fold was always over onto the upper surface of the leaf, but Mr. McConnell has noted that at Greenwood, Miss., larvae feeding on sorghum folded the leaf upward and downward in about equal numbers. The earlier retreats are generally near the tip. Later the edges of a narrow leaf may be drawn together or the margin drawn over to the midrib at any point along the blade. When the roll is complete the larva cuts a deep narrow notch into the leaf at each end and seals the ends. The skill with which the weak and apparently helpless larva manipulates the thick, stiff corn leaf is remarkable.

During the day the larva never leaves its refuge but feeds on the leaf close to the ends of the tube or on the tube itself. At night other parts of the leaf or even other leaves are eaten. When one retreat is outgrown or consumed another is constructed near by. The feeding is spasmodic, sometimes nothing being eaten for two or three days and then in a night almost all of a small plant consumed. When ravenously hungry a larva will cut holes and notches in a leaf without waiting to construct a retreat. The larva at any age seems unable to cling to the naked leaf surface but when moving about always swings its head from side to side laying down silk fibers to which it clings. In this manner it readily climbs a perpendicular glass surface. Excrement is ejected with a snap which sends it to a distance of two or three feet from the plant.

The newly hatched larva is pale yellow with glistening black head and with a single narrow black cervical band separated a short distance from the head and running down on each side to the latero-ventral margin where it ends in a small black dot. The neck-like appearance, caused by a decided constriction of the body just behind the head, is more conspicuous in the later stages as is also the vertical position of the head. The body is provided with scattering minute shining hairs, a pair of which projecting caudad are somewhat larger than the rest. As the larva feeds it assumes a greenish color which, in the second and later instars, is covered with a glaucous, frost-like overcolor. A darker green meso-dorsal line appears and the caudal end of the body becomes flattened and boat-shaped, covering and concealing the caudal pair of legs. A pair of black dots on the third segment from the caudal end becomes more conspicuous with each succeeding molt. The surface of the head becomes granular and sparingly hirsute and under a lens the skin of the body is seen to be covered with minute black bristles.

There are five instars which may be distinguished by the head widths as given below in millimeters:

Instar	Average	Maximum	Minimum
First .....	0.6249	0.6530	0.6063
Second .....	0.9001	0.9328	0.7929
Third .....	1.2599	1.3059	1.2126
Fourth .....	1.7492	1.8656	1.5858
Fifth .....	2.3599	2.5186	2.2387

These measurements were taken from a large number of head casts and while there is considerable variation within each in-

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### A LADY-BEETLE NEW TO FLORIDA

Mr. Geo. F. Merrill adds to the list of Florida Coleoptera the white lady-beetle *Olla abdominalis* Say. It was sent in from Tampa. Its range has hitherto been given as Indiana to Texas and west.

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### THE CORN LEAF-TIER, LEREMA ACCIUS S. & A.

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star, they do not overlap. In the first two instars the head is black, in the last two it is strikingly banded with white in the form of a narrow white band completely encircling the face on the margin and an inverted white V on each side of the face. In the last instar the vertex becomes reddish-brown. The third instar, however, presents both black heads and those striped with white as described for the fourth and fifth. This variation may be due to sex though this was not proven. Two larvae taken near together and having exactly the same head widths showed this difference.

As the larva prepares to molt the new head is formed within the body just caudad of the old one and shortly before the skin breaks there appear to be two distinct heads, even the markings of the new one showing through the epidermis. All the head casts are discarded unbroken except the last one which ruptures along the frontal suture. The pellicles of all except the last molt are very delicate and difficult to find. The larva is pale gray when freshly molted.

A day or two before pupation the larva becomes covered with a distinct white pulverulence. We have observed its first appearance as much as four days before pupation as two powdery white areas on the ventro-lateral margin of the body just caudad of the caudal pair of legs. From this point it spreads until the whole body is covered. It is all carried away with the last exuvium which remains attached to the head cast and is much more bulky than any of the preceding.

Twenty larvae were reared, nine of them completely through from egg to adult. The following table shows in days the length of the different instars and the total larval life.

No. of Larva	First instar	Second instar	Third instar	Fourth instar	Fifth instar	Total larval	Pupa stage	Prob-able egg	Total
*1							32		
*2					21		21		
*3							27		
4	7	5	8	17	10	47	16	9	72
5		6	12	13	13		13		
6	9	10	—26—			45	13	9	67
7							16		
8	—	—	45	—	—	45	12	9	66
9			9	6	24		16		
10	9	8	12	—14—		43	13	9	65
11	11	—23—		—13—		47	14	9	70
12	7	—22—		—16—		45	13	9	67
13	—14—		—17—		5	36	16	9	61
14	8	8	—23—			39	13	9	61
15			12	8			15		
16	8	13	—13—			34	12	9	55
17		8	7	—9—			14		
18			5	—11—			16		
19		8	4	—10—			11		
20		—25—					14		
Average	8.4	8.2	8.6	12	13	42.3	14	9	65

\*These larvae were taken in Florida in November, 1912, and reared indoors at Nashville, Tennessee. They are not included in the averages.

When fully grown the larva covers a portion of the surface of a leaf with silk, suspends itself with a girdle about the thorax and pupates in a fold of the leaf, head downward in most cases. The larval skin breaks along the dorsal line from the head to about the second abdominal segment and is worked back by the pupa to its caudal extremity. The pupa is clear translucent green, 27 mm., long and 5 mm. wide. The anterior end is drawn out into a conical process 3 mm. long. The tongue lies in a straight slender case along the ventral side. Four or five days before emergence the wing pads and thorax assume an opaque whitish color, the eyes begin to darken and finally become deep

purple. The body retains its pale color until a few hours before emergence when it rapidly darkens from the head caudad. The pupal case remains as a crumpled dingy-white skin attached to the leaf. The duration of the pupal stage is shown in the table on page 11. An individual reared at Brownsville, Texas, by Mr. R. A. Vickery remained 11 days in the pupa and Mr. W. R. McConnell noted seven at Greenwood, Mississippi, which emerged in from seven to thirteen days. The maximum reached under out-of-door conditions in Florida was 16 days and the lengthened pupal period of the individuals reared at temperatures greatly below normal at Nashville indicates some power of adaptation to unfavorable conditions in this stage.

The writer has not had the opportunity to follow this species throughout an entire year in the field and all the data at hand concerning its seasonal history are fragmentary. February 11 a first instar larva was found at Brownsville, Texas. June 3 a nearly full grown larva and June 17 a pupa were taken at Greenwood, Mississippi. As early as June 1 a larva nearly full grown, was found at Marion, South Carolina, and September 16 full grown larvae and pupae were found at Clemson College, in the same state, on corn growing in an open greenhouse used as an insectary and at the same place on September 25 on upland rice growing in the open. At Orlando, Florida, larvae survived the mild winter of 1912-13 which was unusually warm even for Florida, there being insufficient frost to injure corn growing in the open. Mr. McConnell attempted without success to carry larvae and pupae through the winter at Greenwood, Mississippi, where they were exposed to freezing, but not severe, temperatures. The great susceptibility to frost of the similar and closely related species, *Calpododes ethlius*, and the probable tropical origin of this species lead to the conclusion that it cannot survive severe freezing weather. If such be the case the butterflies must travel for long distances and very rapidly to reach so early in the summer the localities mentioned above. The larvae in the table on page 11 are arranged in approximate chronological order from November, 1912 to June, 1913, and the figures indicate that the time required for development becomes less as the season advances. At none of the points where this species has been noted do the records indicate any distinct generations, furnishing further support to the theory of its tropical origin; for definite seasonal habits with long

quiescent periods, little or not at all affected by outside influences, are evidence of a long course of adjustment to conditions as found in the temperate zone.

In the spring of 1913 the generations were not distinct, for eggs and larvae of all sizes were found at the same time. The time required for the development of a generation, 65 days not including the time required for mating and oviposition after emergence, indicates that there may be several generations in Florida in one year, and at least two as far north as the species is likely to go. It is probable that it is a continuous breeder in its permanent range and that it travels northward every summer and is killed back every winter as is the case with several others of our economically important insects. However, the fact that *Calpodes ethlius* has reached and caused damage at Washington, D. C., may indicate similar possibilities for this species.

The original account gave American wisteria (*Bradleya frutescens* (L.) Britton) as the food plant but a note adds that it "is most commonly to be met with in the chrysalis state on the blades of Indian corn, *Zea mays*, in which it enfolds itself." Chapman found larvae in the leaves of *Erianthus alopecuroides* (L.) Ell. at Apalachicola, Florida. McConnell found several larvae feeding on sorghum at Greenwood, Mississippi, and one on a grass locally known as "tumble grass," probably *Panicum capillare*, at Memphis, Tennessee. The writer found larvae feeding in leaves of upland rice on the grounds of the South Carolina Experiment Station at Clemson College and a single one in a rolled leaf of Johnson grass (*Sorghum halepense*) at the Florida Experiment Station at Gainesville. All other records give corn as the food plant. Further observations are required to determine the possible food plants but, among cultivated crops, corn will probably head the list.

Three species of parasites have been reared, one from eggs and two from larvae.

*Xenufens ruskini* Gir. Of eleven eggs taken on corn leaves at Orlando, January 28, two were mottled and darker than the rest. On February 10 they had become very dark and on the 20th 12 minute hymenopterons emerged from one egg, and on the 25th, 10 from the other. They left through a small hole in

the apex. The empty shell retained its mottled appearance. Another egg in the same lot appeared normal until February 4 when the shell showed faint mottling which slowly increased until 12 adult parasites emerged on March 10, 42 days after the egg was collected. Eggs of *Calpodes ethlius* occurring in large numbers on canna leaves at Orlando on February 17 were found to be almost 100% parasitized and though most of the parasites had emerged, enough were obtained from the several dozen eggs collected to determine them as the same species attacking the eggs of *Lerema accius*. The parasite was described by Girault\* from specimens reared from eggs of *Eudamus proteus* taken in the same vicinity and at the same time it was found attacking the eggs of *Lerema accius*.

*Microdus* sp. A small dwarfed larva of *Lerema*, taken in the field at Lakeland, April 10, gave forth on the 15th a hymenopterous grub which, after spinning a few threads, pupated in a corner of the box in which its host had been confined. The pupa was 8 mm. long, naked, white except for the eyes and ocelli which darkened as development proceeded. On the 24th the thorax turned yellow, and the adult emerged on the 26th. The adult, which proved to be a female, had a reddish-brown head and thorax, yellow abdomen and black wings.

*Euplectrus insuetus* Gahan. An undersized yellowish larva taken in the field at Lakeland, April 10 almost at once gave forth 16 white grubs which moved a few millimeters from the dead body of their host and transformed to naked pupae attached to the bottom of the box with their ventral sides uppermost. On the 23rd the adults, small Chalcids, emerged. They are black except for the dark eyes and the legs and cephalic half of the abdomen which are pale yellow. From this material the species was described by Mr. A. B. Gahan† as new.

Investigations during the more entomologically active part of the year would undoubtedly reveal more parasites concerned in the control of this species and it seems likely that the ordinary scarcity of the larvae may be attributed to parasitic agency.

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\*Ent. News, Vol. 27, p. 6.

†Proc. U. S. N. M. Vol. 48, p. 164.